

Phylogenetic Relationships of *Pluroides porteri*, a New Genus and Species of Plumariidae from Argentina (Hymenoptera: Chrysoidea)

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Abstract.—*Pluroides porteri*, a new genus and species of plumariid wasp from the provinces of Catamarca, La Rioja and San Juan in western Argentina, is described. The new genus *Pluroides* together with *Mapluroides*, *Maplurius* and *Plumaroides*, belong in a strongly supported South American clade, which is the sister-group to the African *Myrmecopterina*.

Key words.—Plumariidae, taxonomy, phylogeny, Argentina

The Plumariidae are a group of wasps with apterous females of subterranean habits and winged males strongly attracted to lights at night. This family is of particular interest, since it represents one of the basalmost lineages within the Hymenoptera Aculeata. These wasps inhabit desertic and semidesertic areas in southern Africa and South America. Although they are conspicuous faunal elements in some areas, their biology is still unknown.

The family is represented by two genera in Africa (*Myrmecopterina* Bischoff and *Myrmecopterina* Day) and by four genera in South America (*Plumarius* Philippi, *Plumaroides* Brothers, *Maplurius* Roig-Alsina and *Mapluroides* Diez, Fidalgo and Roig-Alsina) (Brues 1924; Bradley 1972; Brothers 1974; Day 1977; Roig-Alsina 1994; Diez *et al.* 2007).

Among South American plumariids, the genus *Plumarius* is the most speciose and has the broadest distribution. Species of *Plumarius* range from Ecuador to southern Argentina (Evans 1966; Nagy 1973; Brothers 1974) with one species recently described from northeastern Brazil (Pentead-Dias and Scatolini 2003). The other three genera are restricted to western

Argentina, from the province of Salta in the north to northern Patagonia in the south (Brothers 1974; Roig-Alsina 1994; Diez *et al.* 2007; Diez 2008). *Plumaroides* has three described, as well as several undescribed species (Diez 2008), while the other two genera are monotypic. Females of only two genera have been discovered to date, those of *Plumarius* (Evans 1966), and *Plumaroides* (Diez 2008).

The purpose of the present contribution is to describe a new genus and species from the provinces of Catamarca, La Rioja, and San Juan in Argentina. Both the generic and specific descriptions are based on the male sex. The relationships of the new genus are studied, taking into account previous contributions and recently described taxa.

METHODS

The specimens studied were collected at night with a camping lantern provided with a fluorescent tube, 360 degrees bright light. The lantern was placed on a white cloth extended on the ground. A few specimens were obtained with a trap designed to collect myrmecophilous insects.

Specimens are deposited at: Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires, Argentina (MACN); Instituto Fundación Miguel Lillo, Tucumán, Argentina (IFML); Museo de La Plata, La Plata, Argentina (MLP); Florida State Collection of Arthropods, USA (FSCA); University of California, Riverside, USA (UCRC).

Terminology follows Brothers (1975).

Pluroides new genus

Type species: *Pluroides porteri* sp. nov.

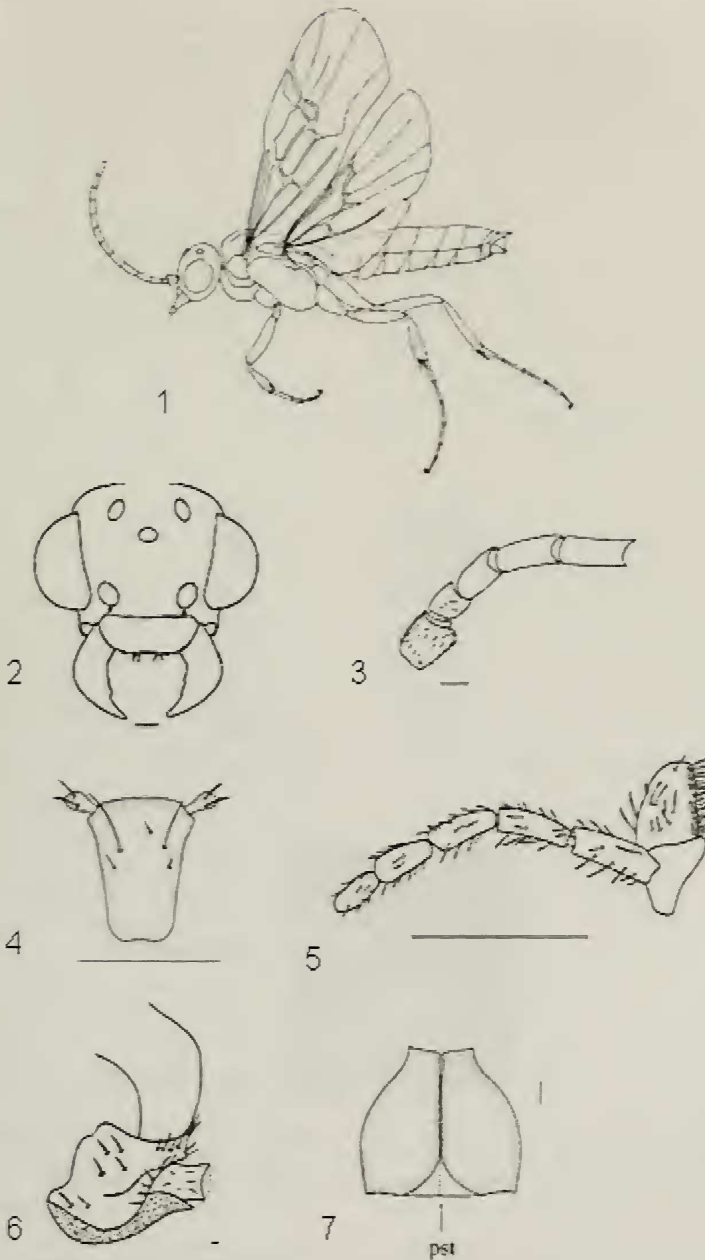
Description.—Preoccipital carina absent. Antenna with 11 flagellomeres; scape as long as wide, with short radicle, ventrally with tuberculiform swelling (Fig. 3); flagellomeres with decumbent, short setae, the longest $0.25\times$ as long as diameter of flagellum. Mandible with three teeth, preapical ones small, blunt, of similar size. Palpal formula: 5:1. Clypeus with epistomal suture distinct; apical margin with weak emargination medially, curved at sides; apical margin bent backwards. Prosternum visible in ventral view, subtriangular (Fig. 7). Forewing with first nebulous vein arising from marginal cell one third below middle of apical margin (Fig. 8). Hind wing with vannal (anal) lobe $3.3\times$ as long as submedian cell (Fig. 9). Claws simple, arolium present only on foretarsus. First metasomal tergum with distinct anterior vertical surface, dorsal surface as long and wide as second tergum. First metasomal sternum with a longitudinal median keel on anterior two thirds, longer than second sternum. Seventh tergum subtriangular, apically rounded; posterior margin forming flat, sclerotized, polished flange, one third as long as tergum (Fig. 10). Seventh sternum broad, with apex weakly bilobed (Fig. 11).

Pluroides porteri new species (Figs 1–13)

Description.—*Holotype male*. **Colour**: pale brown, head darker. Total length 3.5 mm (paratypes, 2.7 to 4.5 mm). Habitus as in

figure 1. **Head**: hypognathous; in frontal view $1.3\times$ as wide as high (Fig. 2), vertex rounded. Eye hemispherical, protruding, glabrous, without pre- or postorbital carinae. Ocellocular distance $3.8\times$ diameter of lateral ocellus; postocellar distance $1.7\times$ ocellocular distance. Antennal socket with lower rim elevated. Antennocular distance $0.3\times$ diameter of antennal socket; inter-antennal distance $6.7\times$ antennocular distance. Gena without furrows or carinae. Area between and below sockets weakly convex. Antenna tapering to apex. Pedicel with narrow base, as long as wide. Proportions of flagellomeres (length:width): 11:7.5; 13:7; 15:7; 14:6; 14:6; 12:5; 13:5; 13:5; 12:5; 11:5; 15:5. Sensory plates sub-oval, scarcely visible, present on flagellomeres 1–6; plates more numerous on basal flagellomeres. Clypeus with several setae of variable size. Labrum with concave apical margin, with two setae at each side. Mandible with broad base and setae of variable size. Labium subrectangular, wider basally than apically, with rounded apex; palp unsegmented (Fig. 4). Maxillary palp with five segments, proportions of segments (length:width): 67:22; 40:21; 33:20; 30:20; 31:20 (Fig. 5).

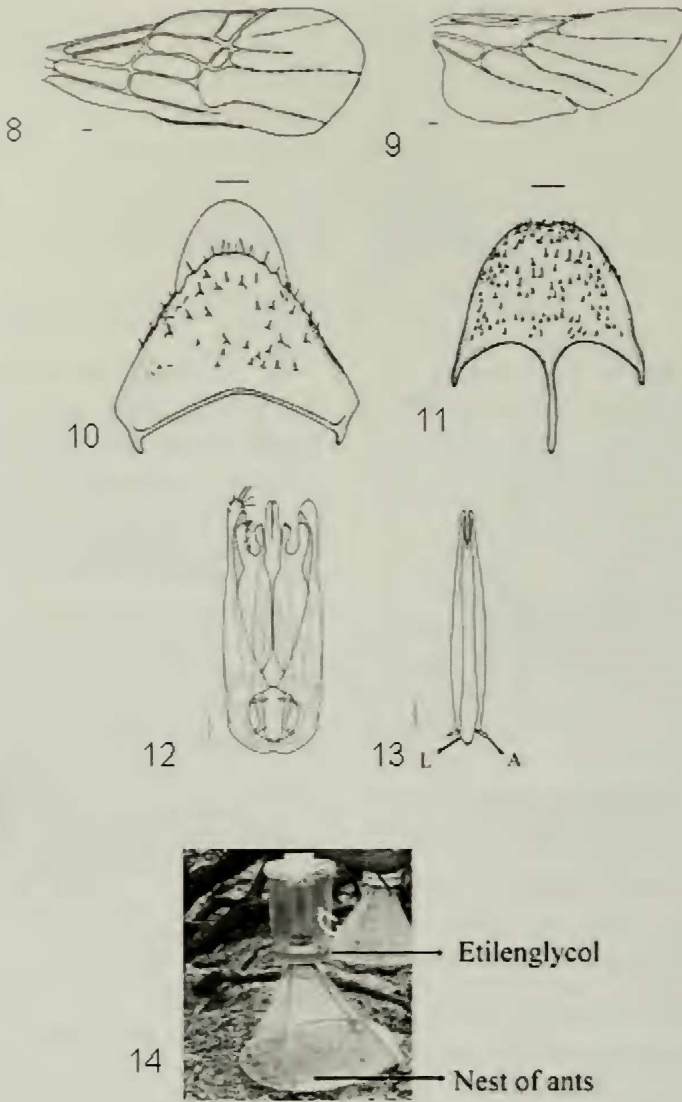
Mesosoma: $1.5\times$ longer than maximum width. Proportions of lengths of mesoscutum, mesoscutellum, metanotum, metapostnotum and propodeum in dorsal view, along median axis: 25: 21: 12: 2: 10. Pronotum not visible dorsally, except for small part of pronotal lobe in front of tegula; in frontal view (head removed) medially forming narrow transverse band which broadens laterally to four times median height. Pronotal lobe flattened, truncate; posteroventral angle of pronotum narrowly rounded (Fig. 6). Propleuron extended anteriorly beyond pronotum. Prosternum visible ventrally as reduced triangular area; most of prosternal surface vertical, hidden by coxae (Fig. 7). Tegula semicircular. Mesoscutum with parapsidal line and notaulus distinct. Mesal area of axillae and scutellum forming nearly hor-



Figs 1-7. *Pluroides porteri* sp. nov.1, habitus of male; 2, head, frontal view; 3, scape, pedicel and first three flagellomeres; 4, labium, ventral view; 5, right maxilla, ventral view; 6, pronotum and mesoscutum, anterolateral view; 7, propleura and prosternum (pst), ventral view. Scale bars = 0.1 mm.

izional, posteriorly directed triangular surface which steeply slants postero-laterally; axillar sutures indicated by conspicuous dark, continuous line. Prepectus much reduced, hidden by pronotum. Hypoepimeral area of mesopleuron limited inferiorly

by dark line running from mesopleural scrobe to meso-metapleural suture; mesepisternal groove present, as short dark line running anteroventrally from mesopleural scrobe. Metanotum subrectangular. Metapostnotum broader medially and narrow-



Figs 8–14. *Pluroides porteri* sp. nov. 8, forewing; 9, hind wing; 10, seventh metasomal tergum, dorsal view; 11, hypopygium, ventral view; 12, genital capsule, ventral view, setae depicted on left side only; 13, aedeagus, dorsal view, apophysis (A), lamina (L); 14, trap for myrmecophilous insects. Scale bars = 0.1 mm.

ing at sides, narrowest at level of propodeal spiracles. Propodeum convex, transverse; propodeal spiracle narrow, removed from anterior margin of propodeum by less than its length. *Wings*: forewing $2.5\times$ as long as maximum width. Pterostigma swollen apically. Marginal cell with anterior margin $2.1\times$ longer than posterior margin; anterior and posterior margins diverging apically; apical margin $1.6\times$ as

long as basal margin, latter slightly curved (Fig. 8). Hind wing with vernal (anal) lobe $3.3\times$ as long as submedian cell; with four hamuli (Fig. 9). *Legs*: slender; tibiae and tarsi with weak, sparse setae. Foretibia with about 13 spiniform setae on outer surface, mainly on apex; spiniform setae fewer on mid tibia and absent on hind tibia. Tibial spurs 1-2-2; anterior tibial spur with approximately 21–22 spines.

Metasoma: in dorsal view $2.1\times$ longer than maximum width, tapering apically. Cercus well developed. Genital capsule as in figure 12; aedeagus with lamina surpassing apophyses basally (Fig. 13).

Etymology.—The species is named after Charles C. Porter, distinguished hymenopterist, who has greatly contributed to the knowledge of neotropical wasps, and who has participated in the collection of Plumariidae in the field.

Type material.—Holotype male: ARGENTINA: province of La Rioja, Ruta 7, 25 Km East of Anillaco, 850 m a.s.l., at light, 22-II-2006, col. P. Fidalgo & G. Fidalgo (MACN). The following are paratypes. **La Rioja:** 1 male, same data as holotype (MACN); 1 male, Ruta 7, 7 Km East of Anillaco, 1200 m a.s.l., at light, 17-II-2006, col. J. Torr ns & P. Fidalgo (IFML); 2 males, 5 Km South of Udpinango, 1000 m a.s.l., at light, 21-II-2006, col. P. Diez, J. Torr ns & P. Fidalgo (MACN, slide); 1 male, Santa Teresita, 736 m a.s.l., at light, 18-II-2006, coll. P. Fidalgo & G. Fidalgo (IFML); 1 male, Ruta 40, Km 395 (between San Blas de Los Sauces and Pituil), 1230 m a.s.l., at light, 9-XII-06, col. P. Fidalgo (MLP). **San Juan:** 1 male, Ruta 141, Km 173 near Caucete, 580 m a.s.l., at light, 14-I-2006, col. P. Fidalgo (MLP). **Catamarca:** 33 males, Ruta 46, km 64, entre Bel n y Andalgal , 965 m a.s.l., at light, 1/2-XI-06, col. P. Fidalgo & P. Diez, (MACN); 3 males, Ruta 46, Km 204, East of Bel n, 965 m a.s.l., at light, 6-XII-06, col. C. Nieto, G. Fidalgo & P. Fidalgo (MACN); 3 males, Ruta 46, Km 64/66 (between Andalgal  and Bel n), 965 m a.s.l., pit-fall traps and trap for myrmecophiles, 2-XI-06 / 6-XII-06 (MACN).

Distribution.—ARGENTINA: Catamarca, La Rioja and San Juan provinces.

Comments.—This new species has been collected in moderate quantities (15 specimens per night) between the localities of Bel n and Andalgal  in Catamarca province and in minor quantities (one or two specimens per night) in different localities of San Juan and La Rioja provinces. Three specimens of *P. porteri*, together with two of *Plumarius* sp. and two of *Plumaroides andalgalensis*, were obtained in a trap specially designed to catch emerging myr-

mecophilous insects from the nest (Fig. 14) of an undetermined species of ant of the genus *Acromyrmex* Mayr (Formicidae, Attini). It is not clear yet whether the life cycle of plumariids may be related to ant nests, or if they use these nests merely as emerging routes.

PHYLOGENETIC RELATIONSHIPS

The relationships among genera of Plumariidae were studied by Roig-Alsina (1994), based on 13 morphological characters. His study found that *Plumarius* and *Myrmecopterina* form a clade which is the sister-group to other plumariids (*Myrmecopterina* (*Plumaroides Maplurius*)). Carpenter (1999) reanalyzed the data presented by Roig-Alsina, adding four new characters taken from Brothers (1974) and Day (1977), supporting the relationships previously found. We present here a more comprehensive analysis, including the new genus *Pluroides*, as well as the recently described genus *Mapluroides*. The analysis is based on 32 morphological characters, and considers species as terminal taxa for the ingroup, not genera as in previous studies. Other families of Chrysoidea have been used for outgroup comparison, since the Plumariidae is the sister group to all other chrysoids. For this purpose the phylogeny of the superfamily presented by Carpenter (1999) was taken into account, and the ground-plan states established for the superfamily were used to polarize characters within the Plumariidae. Characters not studied by Carpenter (1999) were polarized in a similar way, through comparison with other families of Chrysoidea (Table 1).

Species examined for this study are *Plumarius hirticornis* (Andr ), *Plumarius striaticeps* (Andr ), *Plumarius* spp. (several unidentified species from xeric western Argentina), *Myrmecopterina filicornis* Bischoff, *Myrmecopterina* sp. from Northern Cape Province, South Africa, *Maplurius spatulifer* Roig-Alsina, *Plumaroides andalgalensis* Brothers, *Plumaroides brothersi* Diez and Roig-

Table 1. Data matrix for the 32 characters used in the phylogenetic analysis.

| | 1 | 2 | 3 |
|----------------------------------|---|---|---|
| | 0 | 0 | 0 |
| other Chrysidoidae | 0 | 0 | 0 |
| <i>Plumarius hirticornis</i> | 1 | 0 | 0 |
| <i>Plumarius striaticeps</i> | 1 | 0 | 0 |
| <i>Myrmecopterina filicornis</i> | 1 | 0 | 0 |
| <i>Myrmecopterina</i> sp. | 1 | 0 | 0 |
| <i>Myrmecopterina okahandja</i> | 4 | 2 | 0 |
| <i>Maplurius spatulifer</i> | 3 | 1 | 0 |
| <i>Pluroides porteri</i> | 3 | 1 | 1 |
| <i>Mapluroides ogloblini</i> | 2 | 1 | 1 |
| <i>Plumaroides andalgalensis</i> | 2 | 1 | 1 |
| <i>Plumaroides brothersi</i> | 2 | 1 | 1 |

Alsina, *Plumaroides typhlus* Diez, *Mapluroides ogloblini* Diez, Fidalgo and Roig-Alsina, and *Pluroides porteri* n. sp. Character states for *Myrmecopterina okahandja* Day were taken from the literature, because specimens were not available for study.

List of characters (based on the male sex)

1. Labial palpus. Four segments (0). Three segments (1). Two segments (2). One segment (3). Absent (4).
2. Maxillary palpus. Six segments (0). Five segments (1). Three segments (2).
3. Clypeus, apical margin. Straight or projecting, not bent backwards (0). Weakly emarginate, bent backwards (1).
4. Antennal socket. Removed from epistomal suture by one socket diameter or less (0). Removed from epistomal suture by 1.5 socket diameters, or more (1).
5. Antennal pedicel and flagellomeres 1–10, vestiture. Clothed with short setae, at most 0.25 times thickness of flagellomeres (0). Clothed with long setae, as long as or longer than thickness of flagellomeres (1).
6. Antennal pedicel and flagellomeres 1–10, transverse rows of setae. Absent (0). Present (1).
7. Antennal scape. Simple, without swellings or projections (0). With apico-ventral projection, varying from a distinct swelling to a digitiform projection (1). With a basiventral enlargement (2).
8. Number of flagellomeres. Eleven (0). Ten (1).
9. Occipital carina. Present (0). Absent (1).
10. Pronotal collar. Present (0). Absent (1).
11. Ventral angle of pronotum. Rounded (0). Pointed (1).
12. Dorsal area between propleural sclerites. Membranous (0). Anterior portions of propleura expanded dorsally forming tubular neck (1).
13. Epimeral area of propleuron. Present, set off by sulcus above forecoxa (0). Absent (1).
14. Pronotal lobe. Globose, posteriorly rounded (0). Flattened, posteriorly truncate (1).
15. Pronotal lobe. Posterior margin of pronotum continued laterally around pronotal lobe (0). Posterior margin of pronotum laterally forming carina superimposed on pronotal lobe, giving to it bilobate aspect (Fig. 6 in Diez *et al.* 2007) (1).
16. Prosternum, ventral view. Well developed, with distinct apophyseal pit (0). Visible as triangular sclerite, without apophyseal pit (1). Reduced, scarcely visible (2).
17. Prepectus. Well developed, broadest medially and with carinate margins (0). Reduced, as slender bar (1). Reduced, upper half narrow, widest at top, and lower half filiform (2).

18. Scutellum. Normal, flat (0). Produced postero-dorsally as a sharp edged flange (1) (Day 1977).
19. Metapostnotum. Longest medially and narrowing towards propodeal spiracles; posterior margin distinct (0). Widening towards propodeal spiracles; posterior margin distinct medially, but limit between metapostnotum and propodeum indistinct laterally (1).
20. Forewing, second submarginal cell. Present, moderate (0). Present, but reduced (1). Absent (2).
21. Marginal cell of forewing. Anterior margin as long as, or longer than maximum width of pterostigma (0). Cell very short, anterior margin one third to half as long as maximum width of pterostigma (1).
22. Prestigma (first abscissa of R1). Linear, parallel sided except sometimes widened at tip (0). Wide, considerably widened on apical third (1).
23. Vannal lobe of hind wing. Moderate, less than twice (1.3–1.6) as long as submedian cell (0). Large, more than twice (2.1–2.3) as long as submedian cell (1). Exceedingly large (3.3 times as long as submedian cell) (2). The last state is autapomorphic for *Pluroides*.
24. Arolia of mid and hind tarsi. Present (0). Absent (1).
25. Claws. Dentate (0). Simple (1).
26. Mid-tibial spurs. Present (0). Absent (1).
27. Hind femur. Simple, without apical projection at each side of tibial articulation (0). Projected at each side of tibial articulation (1).
28. Ventral surface of hind coxa, specialized area of setae. Absent (0). Present (1).
29. First and second metasomal terga. First tergum in dorsal view narrower than second (0). First tergum in dorsal view as wide as second (1).
30. First metasomal sternum, median longitudinal keel. Absent (0). Present (1).
31. Seventh metasomal tergum. Simple, without carinae (0). Longitudinally carinate (1). With large, flat, sclerotized apical flange as large as 1/3 of tergum (2).
32. Seventh metasomal tergum. Simple, without carinae nor expanded apically (0). Longitudinally carinate (1). With large, flat, sclerotized apical flange as large as 1/3 of tergum (2).

An exact analysis was conducted with the program TNT (Goloboff et al. 2007) using implicit enumeration. Multistate characters were run as unordered. A single most-parsimonious tree resulted (Fig. 15), depicted with the aid of the program Clados (Nixon 1992). The length is 49 steps, with consistency index 0.85, and retention index 0.92. Autapomorphies are included in the tree to show distinctiveness of the taxa (Fig. 15, black squares). When autapomorphies are excluded from the analysis the statistics are: length 39 steps, consistency index 0.82, and retention index 0.92. Five characters (1, 2, 16, 17, and 25) have states with ambiguous optimizations; these are plotted in the figure using the accelerated transformation optimization.

The results of our analysis reinforce the support for the recognition of two major lineages within the Plumariidae, as suggested by previous analyses (Roig-Alsina 1994; Carpenter 1999). One of the lineages is formed by the American *Plumarius* and the African *Myrmecopterina*, both genera clearly monophyletic.

The new genus *Pluroides* and the recently described genus *Mapluroides*, together with *Maplurius* and *Plumaroides*, belong in a strongly supported South American clade, which is the sister-group to the African *Myrmecopterina*. The genus *Plumaroides* has three described species, but current surveys have revealed that it is a speciose group, with several undescribed species. In the tree it appears as supported by three homoplasious states, but at least two of them are clearly convergences, and repre-

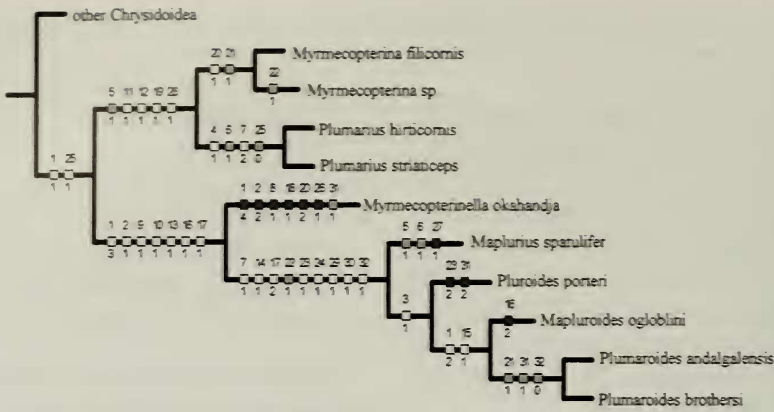


Fig. 15. Cladogram for genera and species of Plumariidae. Character numbers are above the hashmarks, and states are shown below. White squares indicate nonhomoplasious states, gray squares indicate homoplasious states, and black squares indicate autapomorphies.

sent independent derivations: the presence of carinae on the seventh tergum, and the very small marginal cell. The other three genera in this South American clade are monotypic, supported by their own autapomorphies. The new genus *Pluroides* is distinguished by the extremely large vanal (anal) lobe of the hind wing, and the large, flat, polished flange of the seventh tergum, one third as long as the tergum.

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